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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/070,558	05/06/2002	Niels J. Bjerrum	0459-0702P	7042

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EXAMINER	
MARTIN, ANGELA J	

ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 09/08/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/070,558	BJERRUM ET AL.	
	Examiner	Art Unit	
	Angela J. Martin	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 May 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *3/8/02*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 8-11 are objected to because of the following informalities: Claim 8 reads that the "first catalyst layer" can comprise a Pt-Ru catalyst for the anode. However, claim 1 refers to the "second catalyst layer" as being associated with the anode. Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 18, 32, and 33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. Regarding claims 18, 32, and 33, "polysulfone" and "sulfonated polysulfone" renders the claim indefinite because these names comprise a variety of different polymers.

5. Claim 16 recites the limitation "one or more other thermoplastic resins" in lines 2 and 3 of claim 16. There is insufficient antecedent basis for this limitation in the claim since claim 16 is dependent on claim 2, which reads "a thermoplastic polymer".

6. Claim 22 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite in that it fails to point out what is included or excluded by the claim language. This claim is an omnibus type claim.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 1-17, 19, 20, 21, 23, 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rosenmayer, DE 19721952 A1 (International Preliminary Examination Report), in view of Hiroshi, EP 0869568 A1.

Rejection of claims 1-17 drawn to a method of preparation of a polymer electrolyte membrane for fuel cells; claims 19, 20, 21, 23, 24 drawn to a polymer electrolyte membrane for fuel cells.

Rosenmayer teaches a gas diffusion electrode consisting of one or more gas diffusion layers made up from a conductive material, e.g. carbon black, a thermoplastic polymer binder, e.g. polypropylene (col. 4, line 60-col. 5, line 31), and particles of a hydrophobous material, e.g. PTFE (col. 3, lines 59-63). The gas diffusion layer can be prepared by mixing the powder components and extruding them at 250 degrees C to a layer, which is further reduced in thickness by a calendar. Then a catalyst layer is deposited, consisting of a Pt catalyst on carbon black and PTFE as a binder. The

electrode can be a foil of benzimidazole; being soaked with 85% H3PO4 (example 2) and being attached to the catalyst/gas diffusion layer by pressing at room temperature. Next, the layers are placed into a fuel cell testing device to produce a test fuel cell, operated at 130 degrees C (example 2).

Rosenmayer does not teach a hydrophobic carbon support substrate; supporting layer made by casting a slurry; catalyst layer is made from a slurry followed by doping it with a mixture of acids.

Hiroshi teaches a gas diffusion layer arranged between a catalyst layer and separator (abstract; Fig. 2); wherein the catalyst layer is in contact with a solid polymer electrolyte (col. 6, lines 15-35). It teaches the catalyst layer consists of platinized carbon in a perfluorosulfonic acid resin; Gore Select membrane is sandwiched between two catalyst layers and hot pressed (col. 6, lines 35-41). It also teaches the gas diffusion layer consists of a carbon fiber woven cloth, pre-treated with a water-repellant fluororesin (abstract), by immersion into a solution containing PTFE (col. 6, line 47-col. 7, lines 1-10), and a layer of carbon black containing a fluororesin (abstract), deposited by applying a dispersion of carbon black and PTFE (col. 7, lines 11-27). It teaches a weight ratio between fluororesin and carbon black is between 10:90 and 60:40 (col. 5, lines 27-30). Additionally, it teaches the separator is electrically conductive, contains gas channels and is fixed in layers; preparation of a fuel cell (Example 1, col. 7, lines 40-57) consisting of the layers: first separator, first woven carbon cloth, first carbon particle coating, first catalyst layer, electrolyte membrane, second catalyst layer, second carbon particle coating, second woven carbon cloth, and second separator (Fig. 2).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to insert the teachings of Hiroshi, into the teachings of Rosenmayer because the combination of technical features would produce the claimed method of preparation of a polymer electrolyte membrane for fuel cells and the polymer electrolyte membrane for fuel cells.

9. Claims 1, 6, 7, 12-15, 19-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiroshi, EP 0869568 A1, in view of Hards et al., EP 0577291 B1.

Rejection of claims 1, 6, 7, 12-15 drawn to a method of preparation of a polymer electrolyte membrane for fuel cells; claims 19-24 drawn to a polymer electrolyte membrane for fuel cells.

Hiroshi teaches a gas diffusion layer arranged between a catalyst layer and separator (abstract; Fig. 2); wherein the catalyst layer is in contact with a solid polymer electrolyte (col. 6, lines 15-35). It teaches the catalyst layer consists of platinized carbon in a perfluorosulfonic acid resin; Gore Select membrane is sandwiched between two catalyst layers and hot pressed (col. 6, lines 35-41). It also teaches the gas diffusion layer consists of a carbon fiber woven cloth, pre-treated with a water-repellant fluororesin (abstract), by immersion into a solution containing PTFE (col. 6, line 47-col. 7, lines 1-10), and a layer of carbon black containing a fluororesin (abstract), deposited by applying a dispersion of carbon black and PTFE (col. 7, lines 11-27). It teaches a weight ratio between fluororesin and carbon black is between 10:90 and 60:40 (col. 5, lines 27-30). Additionally, it teaches the separator is electrically conductive, contains gas channels and is fixed in layers; preparation of a fuel cell (Example 1, col. 7, lines

40-57) consisting of the layers: first separator, first woven carbon cloth, first carbon particle coating, first catalyst layer, electrolyte membrane, second catalyst layer, second carbon particle coating, second woven carbon cloth, and second separator (Fig. 2).

Hiroshi does not teach the active layer is formed by deposition of a slurry consisting of carbon black, treated with PTFE emulsion, and a platinized carbon black

Hards et al., teach a membrane electrode assembly consisting of three layers: carbon cloth, carbon particulate material, hydrophobic polymer (PTFE) (col. 7, lines 24-36). It teaches an active layer is formed by deposition of a slurry consisting of carbon black, treated with PTFE emulsion, and a platinized carbon black, pretreated with a Nafion solution, dispersed in a mixture of isopropanol/water; the active layer contains 5-60 wt% of polymer; after active layer is dried, a solution of Nafion (acid) is applied on front surface of active layer (col. 9, line 37 through col. 10, line 32). A membrane electrode assembly is formed by hot pressing two electrodes and membrane at 170 degrees C (col. 11, lines 4-8).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to insert the teachings of Hards et al., into the teachings of Hiroshi because the combination of technical features would produce the claimed method of preparation of a polymer electrolyte membrane for fuel cells and the polymer electrolyte membrane for fuel cells.

10. Claims 1-5, 16, 25-29, 31, 32, 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiroshi, EP 0869568 A1, in view of Hards et al., EP 0577291 B1, and in further view of Onorato et al., WO 99/04445.

Hiroshi teaches a gas diffusion layer arranged between a catalyst layer and separator (abstract; Fig. 2); wherein the catalyst layer is in contact with a solid polymer electrolyte (col. 6, lines 15-35). It teaches the catalyst layer consists of platinized carbon in a perfluorosulfonic acid resin; Gore Select membrane is sandwiched between two catalyst layers and hot pressed (col. 6, lines 35-41). It also teaches the gas diffusion layer consists of a carbon fiber woven cloth, pre-treated with a water-repellant fluororesin (abstract), by immersion into a solution containing PTFE (col. 6, line 47-col. 7, lines 1-10), and a layer of carbon black containing a fluororesin (abstract), deposited by applying a dispersion of carbon black and PTFE (col. 7, lines 11-27). It teaches a weight ratio between fluororesin and carbon black is between 10:90 and 60:40 (col. 5, lines 27-30). Additionally, it teaches the separator is electrically conductive, contains gas channels and is fixed in layers; preparation of a fuel cell (Example 1, col. 7, lines 40-57) consisting of the layers: first separator, first woven carbon cloth, first carbon particle coating, first catalyst layer, electrolyte membrane, second catalyst layer, second carbon particle coating, second woven carbon cloth, and second separator (Fig. 2).

Hiroshi does not teach deposition of a slurry consisting of carbon black, treated with PTFE emulsion, and a platinized carbon black, pretreated with a Nafion solution, dispersed in a mixture of isopropanol/water.

Hards et al., teach a membrane electrode assembly consisting of three layers: carbon cloth, carbon particulate material, hydrophobic polymer (PTFE) (col. 7, lines 24-36). It teaches an active layer is formed by deposition of a slurry consisting of carbon black, treated with PTFE emulsion, and a platinized carbon black, pretreated with a

Nafion solution, dispersed in a mixture of isopropanol/water; the active layer contains 5-60 wt% of polymer; after active layer is dried, a solution of Nafion (acid) is applied on front surface of active layer (col. 9, line 37 through col. 10, line 32). A membrane electrode assembly is formed by hot pressing two electrodes and membrane at 170 degrees C (col. 11, lines 4-8).

Hards et al., do not teach the polybenzimidazole.

Onorato et al., teach a polybenzimidazole (PBI) as an electrolyte for fuel cells (abstract); which is in the form of a paste or gel, containing 70-99.9% by weight of imbibed acid (p. 2, lines 15-27). The acid may be a solution of 5-95 wt% of pure acid, wherein the acid is H3PO4, H2SO4, acetic acid, trifluoroacetic acid, and mixtures (p. 4, lines 19-32); H3PO4 is preferred with a preferred concentration of 85 wt% (p. 3, line 27 through p. 5, line 26). It teaches the acid-soaked PBI gel or paste is applied to a fabric or film, which may consist of a series of different polymers, including PBI and its derivatives (p. 6, lines 1-19); fabric can be soaked with acid so that fabric contains 40-90 % acid by wt, preferably 50-75 wt%, with polymers of PBI and polypyridine and their mixtures with other polymers (p. 7, lines 5-22). It teaches the electrolyte film applied between two catalytic layers may consist of a fabric layer sandwiched on both sides with a layer of a PBI gel (Example 3).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to insert the teachings of Hards et al., and Onorato et al., into the teachings of Hiroshi because the combination of technical features would produce the

claimed method of preparation of a polymer electrolyte membrane for fuel cells and the polymer electrolyte membrane for fuel cells.

11. Claims 17, 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Onorato et al., WO 99/04445, in view of Sansone et al., U.S. Pat. No. 5,599,639 A

Rejection of claims 29 and 30 drawn to a solid electrolyte for polymer electrolyte membrane fuel cells.

Onorato et al., teach a polybenzimidazole (PBI) as an electrolyte for fuel cells (abstract); which is in the form of a paste or gel, containing 70-99.9% by weight of imbibed acid (p. 2, lines 15-27).

Onorato et al., do not teach poly-2,2'-(m-phenylene)-5,5'-bibenzimidazole.

Sansone et al., teach poly-2,2'-(m-phenylene)-5,5'-bibenzimidazole (col. 2, line 31).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to insert the teachings of Sansone et al., into the teachings of Onorato et al., because Sansone et al., teach a specific polybenzimidazole.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Angela J. Martin whose telephone number is 571-272-1288. The examiner can normally be reached on Monday-Friday from 9:00 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AJM